

## **The Epistemic Structural Realist Program. Some interference**

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The paper is intended to assess the prospects of Epistemic Structural Realism (ESR) to constitute a sound realist response to antirealist preoccupations raised by deep historical changes in science. This aim is achieved contrasting various forms of ESR with a case of theoretical change in the history physics. In particular, I will devote my attention to the explanation of the Zeeman effect offered in Lorentz Theory of Electrons and how it looks from the perspective of Relativistic Electrodynamics. The various positions will be contrasted with this case and the prospects of ESR evaluated in this context.

Deep changes in theoretical frameworks constitute a major challenge for realist positions on science. The family of antirealist arguments that exploits this historical fact goes under the headings of pessimistic meta-induction (PMI). The argument questions the fundamental idea that an abductive inference from success to truth is legitimate and it is the only possible explanation of the success of science (NMA). It does so drawing on the historical lesson: the past dismissed theories where after all instances of the success of science but they are now taken as false. On one hand there is a wide range of realist attacks to PMI. On the other hand, several theories in the history of physics exhibit commonalities captured by mathematical structures. Worrall turned one of this cases into a proposal for an highly debated version of realism. He insisted that we are justified in believing in the equations of our best physical theories. These theoretical features are in fact immune from the theoretical changes that are the focus of the antirealist's concern. The case in point was the retention of Fresnel's equations in Maxwell's electromagnetism. Worrall's picture conceded something to the antirealist: Fresnel's ether is gone, no track of it remains in modern science. Nonetheless we do have knowledge. But it is knowledge of structure and it is not knowledge of entities. Hence we ought to embrace Epistemic Structural Realism (ESR). This view features a variety of alternative views that range from the adoption of the Ramsey Sentence to updated versions of Russellian Structural knowledge.

In this work, I intend to present ESR with a concern. Particular cases of past scientific success are problematic for ESR. They trap its advocate in a dilemma: either ESR has nothing particularly structuralist to offer in defence of realism – where structural refers to certain kinds of relations that allegedly survive to the change; or a defence based merely on structural features might not be sufficient to support a form of realism. This result will emerge through the analysis of ESR and of various criticisms available in the literature concerned with the topic. The background of such analysis is the study of the prediction of the Normal Zeeman Effect (NZE). NZE is notoriously a phenomenon of alteration of the frequency of light due to the effect of a magnetic field on its source. Depending on the intensity of the magnetic field the effect of alteration of the spectrum of light varies considerably and a family of diverse effects are possible. The model adopted for the prediction in the Lorentz theory of Electrons explains the Zeeman Effect as precession in the period of oscillation of a radiating charge. The radiating charge is an electron whose acceleration explains the emission of light. The alteration on the period of oscillation of the electron due to the magnetic force exerted by the field determines an alteration in the frequency of the light. The core features of this explanatory model are the Lorentz Force and a model of the electron as extended body featuring an harmonic motion.

The harmonic motion and the Lorentz Force can feature a relativistic explanation as well but the Relativistic version of the model prescribes a point charge. A point charge is in turn incompatible with the original classical explanation. Furthermore, a variety of physical magnitudes involved in the prediction undergoes to a significant shift from the classical to the relativistic context. In this context I

test the Epistemic Structural Realist Program.

I argue that this case despite is *prima facie* favorability to the structuralist cause put a considerable impose a specific development in the position. After having set the physics stage, I go on to articulate this argument analysing the presupposition that lie behind (the various version of) ESR and disambiguating the various conceptions of structure that are left entrenched in the literature. The contrast with the case study will show that a particular development of the position seem to offer the best prospects.